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四川资中侏罗纪一新的半椎鱼类及其生物地层意义

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摘要　本文记述的棘背天府鱼(新属新种)发现于四川资中沙溪庙组。它具有大的顶骨、少的次眶骨及无饰缘棘鳞等特征，与新鳞齿鱼(*Neolepidotes*)相似；另外具有很发达的棘状背峭鳞、少的次眶骨及鳞片无杵臼式关节等特征，与半椎鱼(*Semionotus*)很相似。天府鱼以其长大的顶骨、较居后的颌关节、较短的眶前距、很发达的棘状背峭鳞及无饰缘棘鳞等特征，有别于半椎鱼科中所有已知属。根据天府鱼和过去记述的鱼化石，仍认为含鱼层的时代可能为中侏罗世。

关键词　四川资中，中侏罗世，半椎鱼科

四川盆地中生代地层颇为发育，且含有丰富的鱼化石，从晚三叠世至早白垩世均已有所发现。本文记述的鱼化石是资中县丰裕乡第八大队农民罗永祥于1979年秋开采石料时发现的，而后赠送给本所在该地区考察的工作队董枝明和唐治路同志，再由他们转交给笔者作鉴定。这块鱼化石埋藏在灰紫色细砂岩中，其产出层位据董枝明和唐治路观察，应属上沙溪庙组。现经笔者研究，它被确定为半椎鱼科(Semionotidae)一新属种——棘背天府鱼(*Tianfuichthys spinodorsalis*)。天府鱼有些形态特征似浙江馆头组和辽东新宾下桦皮甸子组的新鳞齿鱼属(*Neolepidotes*)，但另有许多重要特征更接近欧美早侏罗世的半椎鱼属(*Semionotus*)。这个新发现将有助于进一步了解上沙溪庙组的鱼群性质及其地质时代。

一、标 本 记 述

新鳍鱼次纲 Neopterygii
半椎鱼目 Semionotiformes
半椎鱼科 Semionotidae
天府鱼属(新属) *Tianfuichthys* gen. nov.

属型种　*Tianfuichthys spinodorsalis*

属的特征　身体中等大小，纺锤形。颅顶宽大。额骨长而宽。顶骨长大，右顶骨较

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长，其长度约为额骨长的一半以上。膜质蝶耳骨不合并入颅顶，而构成眼眶后上缘。眼眶较靠前，围眶骨可能完全，眶上骨至少有2块；眶下骨系统至少由7块骨片(包括膜质蝶耳骨)组成。次眶骨可能多于1块。下颌骨具有颇高的冠状突。鳃盖骨很大，高颇大于宽。前鳃盖骨镰刀形，水平枝颇向前伸长，与垂直枝相交组成内夹角几成直角。额外肩胛骨数目多，成片状。上匙骨很高大。有两块后匙骨。背鳍位置对着腹鳍和臀鳍之间处。腹鳍距臀鳍比距胸鳍为近。尾鳍半歪形。饰缘棘鳞不发育或缺乏。在头后和背鳍之间具有一列很发达的棘状背嵴鳞。鳞片菱形，表面近乎光滑。体侧鳞高略大于宽，其前上角和前下角不伸长成突。鳞片的杵臼式关节不发育。沿体轴的鳞列约35列。头部感觉管似古鳕科，眶下感觉管不与眶上感觉管连接。

棘背天府鱼 *Tianfuichthys spinodorsalis* sp. nov.

(图1—2；图版I，1—4)

正型标本 一近乎完整的鱼(头骨脱落，保存有印模)。中国科学院古脊椎动物与古人类研究所标本登记号V4095A；一与正型标本分离的头骨(V4095B)。

特征 同属的特征。

产地与层位 四川资中县丰裕乡；上沙溪庙组(中侏罗世)。

释名 属名*Tianfuichthys*由化石产区四川的古称——天府的汉语拼音和希腊字-ichthys(鱼)组成；种名由拉丁字spino（棘）和dorsalis（背）组成，表示这种鱼背部具有似棘状的嵴鳞。

描述 身体中等大小，正型标本全长约达250毫米，呈纺锤形。背缘显然隆起，最大体高在胸鳍和腹鳍之间，体长约为体高的3.25倍。头较小，其长颇小于体高。尾柄较细长，其长显然大于其高。

头骨由于采集时不慎而与鱼体分离，保存成立体状，可以观察到背、侧面的骨片。头部骨片保存虽不完全，但其结构基本上可以辨认。

吻部与颅顶 头部前端缺失，吻部骨片和鼻骨无法得知。颅顶宽阔，膜质骨表面近乎光滑。额骨(Fr)长而宽，右额骨前部残缺较多，左边的也稍有残缺，但可以看出其前端向前突伸。额骨的中部即在眼眶之上处略收缩，在眼眶之后处略扩大，其后缘略向后突伸。右额骨后缘更向后突伸。顶骨(Pa)颇长大，左右两者不对称，其大小和形状均有差异，左顶骨长稍大于宽，略呈长方形；右顶骨比左顶骨长，且颇大于其宽，前端向前突伸成尖状，插在两额骨后部之间。膜质翼耳骨(Dtp)较发达，长条形，前部变窄向前突伸。额外肩胛骨(Ext)有5块，均略呈片状，居中者(Ext_3)较宽大，前缘中部略向前突伸；居左侧两块的长度均略大于宽；居右侧两块的大小和形状略有差异。

颊区与鳃盖系统 眼眶较大，位置颇靠前。围眶骨系统保存较完全。眶上骨，至少有2块，前面的那块较小，前部稍残缺；后面的那块较大，略呈长方形，上缘略拱起，下缘稍向上弯。眶下骨系统至少由6块眶下骨(Ifo)和1块膜质蝶耳骨组成。在眼眶下缘约有3块较小的眶下骨，最前面的那块略呈长方形；第2眶下骨略呈方形；第3和第4眶下骨残缺不全，据其印痕，似呈梯形；第5眶下骨最大，后部宽大于前部，略呈横置梯形；第6眶下骨也较大，略呈方形，背缘与膜质蝶耳骨相接。膜质蝶耳骨(Dsph)

相当大，上部较宽，下部略变窄，略呈倒置梯形，组成眼眶的后上缘，其前缘与第2眶上骨相接，后上缘与膜质翼耳骨相接。眶下感觉管经过膜质蝶耳骨进入膜质翼耳骨，不与眶上感觉沟汇合。次眶骨(Sbo)可能多于1块，除在第5眶下骨和前鳃盖骨之间有一很大而略呈长方形的次眶骨外，还在第6眶下骨之后有一残破的骨片，可能是一较小的次眶骨。鳃盖骨(Op)很大，保存有较好的印模，高甚大于宽，几呈长方形，但其四角均颇为圆钝。前鳃盖骨(Pop)呈镰刀形，上枝长而窄，近乎直立；下枝较宽，略短于上枝，颇向前折伸；上、下两枝相交组成的内夹角几成直角。下鳃盖骨(Sop)保存有前部，下部保存有印模，略呈长三角形，但其前上角颇向上突伸，插在前鳃盖骨和鳃盖骨之间。间鳃盖骨(Iop)仅保存有印痕，可能很窄小，居下鳃盖骨之前、前鳃盖骨下枝的下面。鳃条骨(Br)仅保存有一些骨片痕迹，难以确定其数目。

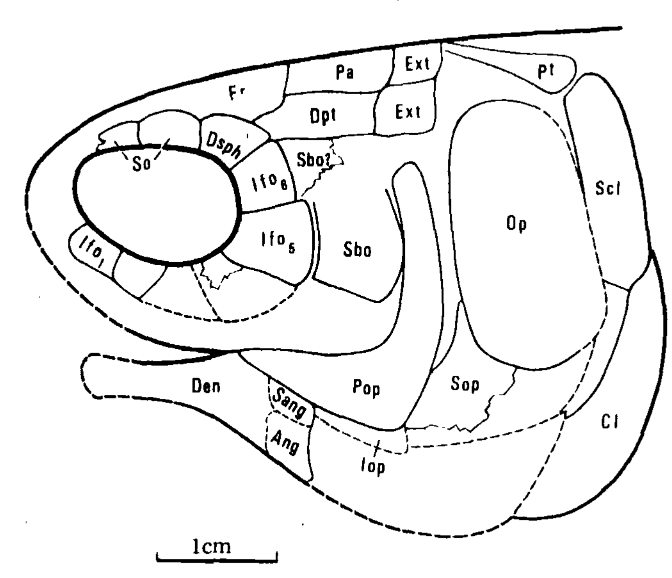


图1　棘背天府鱼(新属新种)的头骨，左侧视依正型标本

Fig.1　The skull-bones of *Tianfuichthys spinodorsalis*, gen. et sp. nov., based on the Holotype, left view

上、下颌　口裂较小，上颌骨和前上颌骨均未有保存。下颌骨可能因受挤压向后错动，其后部伸到前鳃盖骨下枝前部的下面。齿骨(Den)很粗壮，前端略有残缺，口缘由前向后逐渐升高，约到齿骨全长的2/3处显著升高，形成颇高的冠状突。齿骨腹缘不平直而略向上拱起。齿骨口缘保存有一些牙根的印痕，证明牙齿较大，可能呈铁笔形。隅骨(Ang)和上隅骨(Sang)构成下颌骨的后部。前者较大，后者很小。

肩带与偶鳍　匙骨(Cl)保存有较好的印模；很强壮，上部窄尖，向下逐渐扩大，下部颇向前折伸。上匙骨(Scl)很高大，呈板状，其高约为鳃盖骨高的5/6。后颞骨(Pt)较窄小，向前逐渐变尖，与额外肩胛骨相接。后匙骨在V4095A号标本上保存有两块印模：上面那块较高，呈长三角形；下面那块高略大于宽，呈长方形。胸鳍没有保存。腹鳍仅保存几根残破的鳍条，其起点对着背鳍的起点和第12—13列横列鳞。

奇鳍　背鳍很靠后，居背缘急剧降低处，鳍前具有4根粗壮的基部棘鳞，由前向后

依次增长，其后继而约有8根远端分叉和分节的鳍条。饰缘棘鳞不发育。臀鳍残缺不全，仅保存前面2根鳍条近端部分，其起点对着第18列横列鳞。尾鳍属于半歪型，鳞叶较长。尾上叶鳍条缺失。尾下叶保存有9根鳍条的印模，除近基部有一段不分节外，其余部分均密分节，远端均分叉。

鳞片与嵴鳞 躯干上大部分鳞片脱落，但保存有较完好的印模，据此可以确定鳞片为菱形，体侧鳞不显著加高，只有靠近肩带后有数列体侧鳞高显然大于宽。鳞片覆压区较窄，前上角和前下角不向前伸长成突。上、下毗邻的鳞片未见杵臼式关节。鳞片被有釉质层，表面近乎光滑，后缘未见锯齿。从肩带后沿体轴至尾基鳞叶开始倒转处至少有35列鳞片。在肩带后从背缘至腹缘的斜列鳞约有13个。在胸、腹鳍之间最大体高处从背缘至腹缘的斜列鳞至少有18个。从腹鳍起点处至背缘约有15— 16个鳞片。从尾柄背缘至腹缘的斜列鳞有8 个。

背嵴鳞很发达，在头后和背鳍之间具有一列长大而似棘状的背嵴鳞(至少13根)，插生在头后第8至19列斜列鳞上面，但不与背鳍相连，其间还有3个粗大而不成棘状的鳞片相隔。这些背嵴鳞彼此之间略有间距，表面被有釉质层，颇为光滑。从背鳍后至尾柄的背缘至少有12对粗壮而光滑的背缘鳞片，继而与尾上叶基部棘鳞相接。躯干腹缘未见腹嵴鳞，很可能不发育。

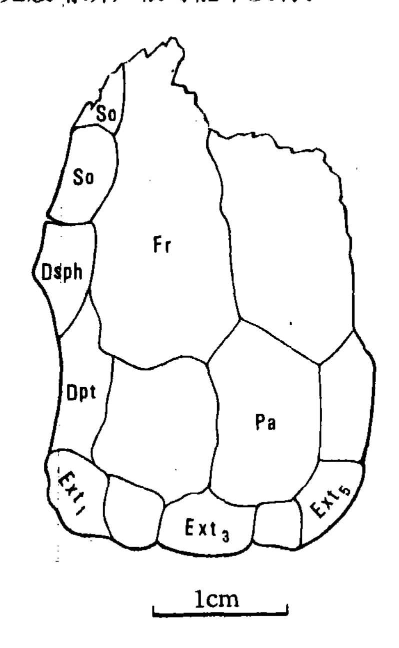


图2 棘背天府鱼(新属新种)的头骨，背面视依正型标本

Fig.2 The skull-bones of *T. spinodorsalis*, based on the Holotype, dorsal view

Abbreviations: Ang, angular; Cl, cleithrum; Den, dentary; Dpt, dermopterotic; Dsph, dermosphenotic; Ext, extrascapular; Fr, frontal; Ifo, infraorbital; Iop, interopercular; Op, opercular; Pa, parietal; Pop, preopercular; Pt, posttemporal; Sang, surangular; Sbo, suborbital; Scl, supracleithrum; So, supraorbital; Sop, subopercular.

正型标本(V4095A)测量(单位：毫米)

(Measurements of the Holotype: in mm)

全长(Total length) ……………………………………250 (ca.)

体长(Approximate length along level of axial line to beginning of caudal inversion) ……182

体高(Maximum depth of body) ……………………………………56

头长(Length of skull) ··· 44
头高(Depth of skull) ··· 38
尾柄长(Length of caudal peduncle) ··· 37 (ca.)
尾柄高(Depth of caudal peduncle) ··· 16

比较 以上所描述的新属——天府鱼在某些形态特征方面与浙江馆头组和辽东下桦皮甸子组所产的新鳞齿鱼属相似，例如：它的颅顶部较宽，具有长大的顶骨；膜质蝶耳骨不合并到颅顶而参加围眶骨环；次眶骨数目少；下颌具有高的冠状突；有很高大的鳃盖骨；鳍只有基部棘鳞而无饰缘棘鳞；体侧鳞不显著加高。但天府鱼具有以下几点很显著的特征不同于新鳞齿鱼属：背鳍位置较靠后；颌关节在眼眶之后；眶下感觉管不与眶上管连接；有较多而呈片状的额外肩胛骨；前鳃盖骨的上、下枝组成的内夹角几成直角而不成钝角；肩带部有2块后匙骨；有一列很发达而成棘状的背嵴鳞，永康新鳞齿鱼的背嵴鳞不成长棘状，辽东新鳞齿鱼则无背嵴鳞；鳞片缺乏杵臼式关节或不发育；沿体轴的鳞列较多(约35列)，但在新鳞齿鱼中仅有28— 30列。天府鱼还有许多形态特征例如它有标准纺锤形的身体、奇鳍和偶鳍相对的位置、颅顶膜质骨和围眶骨的排列式样、有少的次眶骨、有很发达而成棘状的背嵴鳞及鳞片显示的特征等，与欧美等地所产的半椎鱼属很相似，但天府鱼的鳍前缘无饰缘棘鳞、眶前距较短、颌关节较靠后、前鳃盖骨直立，上、下枝相交所成的内夹角度数较小。此外，据Olsen和McCune (1991)描述，半椎鱼属的“上耳骨”(“Epiotic”)具有大而朝向后的突伸，而在天府鱼中却未见到。根据以上的比较和特征，天府鱼既有别于新鳞齿鱼属，也有别于半椎鱼属，无疑代表一新属、新种。

二、讨　　论

1. 关于天府鱼的系统位置

天府鱼的有些形态特征与新鳞齿鱼属相似已如上述。新鳞齿鱼属由张弥曼和周家健(1977)根据产自浙江永康馆头组(早白垩世)的若干保存不完全的标本所建，其属型种为永康新鳞齿鱼(*Neolepidotes yunkangensis*)。原作者根据新鳞齿鱼颅顶结构、颌部构造、牙齿、鳃盖系统及鳞片形状等特征，与欧洲侏罗纪至白垩纪地层中常见的鳞齿鱼属(*Lepidotes*)作了比较，将新鳞齿鱼列于半椎鱼目的半椎鱼科。后来，金帆(1987)根据产自辽宁东部新宾县下桦皮甸子组(晚侏罗世)一批保存较好的标本建立了辽东新鳞齿鱼(*Neolepidotes liaodongensis*)。他从头骨、感觉管系统、鳍及鳞片等方面补充描述了新鳞齿鱼属的特征，并将其与鳞齿鱼属作了进一步的比较，确认它们之间有许多重要的区别。同时认为新鳞齿鱼有许多特征与半椎鱼科基本一致，惟脊椎骨化较完全，饰缘棘鳞不发达，与科的特征有些出入，故将新鳞齿鱼属暂列入半椎鱼科。那么，天府鱼究竟归属于哪科为宜？以上已叙述过，天府鱼的头骨膜质骨特别是次眶骨数目、鳞片的结构及有发达的背嵴鳞等，与半椎鱼属最相似。这显示着天府鱼与半椎鱼有密切的关系。而且它的主要特征也基本上与半椎鱼科的特征(Woodward，1895；Lehman，1966)一致，也

只有饰缘棘鳞不发育有些差别。然而，在McCune (1986) 重新研究欧洲三叠纪和侏罗纪半椎鱼属许多种的基础上，Olsen和McCune (1991) 又对北美纽瓦克超群(Newark Supergroup)上部所产的半椎鱼属的形态作了重新研究，并修正了半椎鱼科的特征，并将许多属从此科中排除出去。按照他们的意见，这个狭义的科仅包括有半椎鱼属和鳞齿鱼属，并着重指出具有以下两个共有的进化特征：1) 有背嵴鳞(Dorsalridge scales)；2) "上耳骨"("Epiotic")具有大而朝后的棘突(process)。如果根据上述的新定义，天府鱼虽然其上耳骨的结构还不明，但它具有很发达的棘状背嵴鳞。根据此点，也可以将天府鱼列入半椎鱼科。

2. 关于含鱼化石地层的时代

棘背天府鱼标本据本所四川野外工作队董枝明和唐治路(1979)调查确定，产于资中县上沙溪庙组。这个组的地质时代长期以来有争议，有些地质古生物学家认为属中侏罗世，如顾知微(1962、1976)根据瓣鳃类化石，斯行健和周志炎(1962)根据植物化石均认为属中侏罗世；苏德造(1974)研究上沙溪庙组的褶鳞鱼类化石时也认为是中侏罗世；四川省区域地层表编写组(1978)将有的地区的沙溪庙组划分为上、下两个亚组，均归于中侏罗世。另一些古生物学家，如杨鍾健和赵喜进(1972)、董枝明(1980)根据恐龙化石将上沙溪庙组定为晚侏罗世早期。现在，笔者根据新发现的天府鱼的性质，再讨论一下这个组的时代问题。前面已叙述到，天府鱼的某些形态特征虽与浙江馆头组、辽宁东部下桦皮甸子组(J_3)所产的新鳞齿鱼属有些相似，但它是与后者显然有别的新属。它在某些结构上如尾部鳞叶较长等显示着比新鳞齿鱼原始一些，其生存时代很可能早一些。从天府鱼主要的进化特征而论，它与北美东部纽瓦克超群上部、欧洲晚三叠世至侏罗纪地层中常见的半椎鱼属最接近。长期以来，纽瓦克超群一直被认为属晚三叠世，直到本世纪70年代初，一些地质古生物学家如Cornet, Traverse 和 McDonald (1973) 根据孢粉和鱼化石研究的新证据，将纽瓦克超群含半椎鱼属和褶鳞鱼属(*Ptycholepis*)等化石的上部划归为早侏罗世。然后，Schaeffer和McDonald (1978) 重新研究了纽瓦克超群多类鱼化石后，明确地指出，这个超群中的各类鱼化石在生存时代上存在着一些有趣的变化：雷氏鱼属(*Redfieldius*)全属里阿斯期(Liassic)，而其他雷氏鱼类(redfieldiids)仍属晚三叠世；马修氏褶鳞鱼(*Ptycholepis marshi*)亦显然限于里阿斯期；半椎鱼属中有一种仍属晚三叠世，而其他许多种均为里阿斯期。至于欧洲所产的半椎鱼原包括有很多种(约41个)，经McCune (1986) 重新研究订正，只有4个种被认为有效。这4个种是：*Semionotus bergeri*、*S. kaffi*、*S. normanniae* 及 *S. minor* (= *Lepidotes minor*)。前三者分别产于西德、法国及瑞典晚三叠世地层，只有后者产于英国晚侏罗世。从上述半椎鱼在地上分布的情况来看，它主要生存于晚三叠世至早侏罗世而更繁盛于后一时代。这表明与半椎鱼十分相似的天府鱼的生存时代不会太晚，有可能属早中侏罗世。但从天府鱼所显示的某些进化特征如饰缘棘鳞很退化和背嵴鳞更特化等表明，它比半椎鱼进步一些。其生存时代可能为中侏罗世。这个结论也可以从以下的事实得到进一步的证明。过去在沙溪庙组已发现了颇与欧洲里阿斯期、北美纽瓦克超群上部(现属早侏罗世)的褶鳞鱼科(Ptycholepidae)相似的重庆鱼(*Chungkingichthys*)和相似于褶鳞鱼属的渝州鱼(*Yuchoulepis*)。这两类均属原始辐鳍鱼类，其地质时代定为中侏罗世。综上所述，这

个鱼群目前主要由两类原始辐鳍鱼类和一类以天府鱼为代表的全骨鱼类组成，而未发现常见于晚侏罗世的真骨鱼类，整个鱼群显示着较古老的面貌。所有这些事实都说明把含这个鱼群的地层时代订为中侏罗世是比较合理的。

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A NEW SEMIONOTID FISH FROM THE JURASSIC OF SICHUAN BASIN AND ITS BIOSTRATIGRAPHIC SIGNIFICANCE

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Key words　Zizhong, Sichuan; Middle Jurassic; Semionotidae

Summary

The fossil fishes described here were collected from the Upper Shaximiao Formation of Zizhong, Sichuan, and are referred to a new genus and species, *Tianfuichthys*

spinodorsalis, of the Semionotidae. *Tianfuichthys* resembles *Semionotus* in many respects, and *Neolepidotes* in some respects. It is characterized by extraordinarily spine-shaped dorsal ridge-scales, large parietals, few suborbitals, lacking fringing fulcra, and distinguished from all the known genera in the family. By *Tianfuichthys* and known fossil fishes, the age of the fish-bearing beds is probably Middle Jurassic. This new discovery is of great signific ance to the study of the biostratigraphy in Sichuan Basin.

Infraclass Neopterygii

Order Semionotiformes

Family Semionotidae

***Tianfuichthys* gen. nov.**

Type species *Tianfuichthys spinodorsalis*

Generic diagnosis Body of moderate size, moderately deep-fusiform. Skull roof broad and flat, with long frontals and large parietals. The latter unequal in size and shape, right parietal longer than left one, its length more than half that of frontal. Dermosphenotic incorporated in the skull roof, composing posteriorupper border of the orbit. Extrascapulars numerous and lobate. Orbits relatively anteriorly placed, circumorbital ring pobably complete. Supraorbitals two at least. Infraorbital series consisting at least of seven bones (including dermosphenotic). Suborbitals probably more than one in number. Snout pronounced and mouth gape relatively small. Dentary with gradually elevated coronoid process. Opercular apparatus well developed, with a narrow sickle-shaped preoperculum. Operculum very large and much deeper than broad. Supracleithrum very strong. Two postcleithrum present. Dorsal fin posteriorly placed, opposing to the space between the pelvic and anal fins. Pelvic fins nearer anal fin than the pectoral fins. Caudal fin hemiheteroceral, with comparatively long body-lobe. No fringing fulcra. The dorsal ridge-series of acuminate scales forming a prominent crest. Scales rhombic, almost smooth. Flank scales not much deeper than broad, with their narrow overlapped margins not produced at the angles. Peg-and-socked articulation inconspicuous or not present. About thirty-five transverse rows of scales on the body. Supraorbital sensory canal ending in parietal and having no anastomosis with infraorbital sensory canal.

***Tianfuichthys spinodorsalis* sp. nov.**

(Figs. 1—2; Pl. I, 1—4)

Holotype A nearly complete fish. Cat. No. V4095A of IVPP.

An isolated skull of the holotype (V4095B).

Diagnosis As for genus.

Horizon and locality Upper part of Shaximiao Formation (probably Middle Jurassic); Fengyu xiang, Zizhong xian, Sichuan.

Description Type specimen attains to a length of about 250mm, having moderately deep-fusiform body. The maximum depth of body, which is situated midway between the pectoral and ventral fins, is 1/3.25 of the length of body. The head is comparatively small, its length less than maximum depth of body. Caudal peduncle is relatively slender, its length is much more than its depth. The measurements of the holotype are in Chinse text.

The skull is incompletely preserved, the bones of the rostrum are broken. The anterior parts of the frontals were missing, being somewhat contracted above the orbits, slightly broadened in hinder parts, and the median suture between them more or less wavy. A pair of parietals are rather large, left parietal is almost rectangular, but right one have an anteromedian extension inserting between the posterior parts of a pair of frontals. The dermopterotics are lath-shaped, having an anteriolateral extension bordering the frontal. There are about five lobate extrascapulars just behind the skull roof.

The orbits are comparatively large and their distances of the preorbits appear to be relatively short. The circumorbital ring is probably complete, but its antorbital bones were missing. There are about two strong supraorbitals above the orbit. The infraorbital series consist of at least six infraorbitals and a large dermosphenotic. The uppermost infraorbital is rather large and almost square, fifth infraorbital is the largest and almost trapezoid, the others gradually attenuate forward. There is a large and a small suborbitals between the orbit and preoperculum, the former nearly rectangular, the latter was incompletely preserved. The opercular is very large, much deeper than broad, and almost rectangular. The subopercular was broken, having a long ascending process at its antero-superior angle. The preopercular is sickle-shaped, its horizontal limb is much extended forward ventrally, but is slightly shorter than its vertical limb. The interopercular appears to be a very narrow bone. The branchiostegal rays are represented by a bit of fragmentary elements. The upper jaw is badly preserved. The lower jaw consists of a large dentary, a medium-sized angular and a small surangular. The former is considerably deepening from the symphysis backwards. The marginal teeth are probably styliform. The cleithrum and supraclethrum are very strong, the former curves well forwards, the latter is a deep and broad plate of bone. The upper postcleithrum is much deeper than broad, almost elongate-triangular. The lower is somewhat deeper than broad, and nearly rectangular.

No trace of the pectoral fin is preserved. The dorsal fin is short-based, consisting of about eight distally segmented and branched rays, the first ray is bordered by four basal fulcra, destitute of fringing fulcra. The pelvic and anal fins are represented by

a bit of fragmentary rays. The origin of the former opposed to that of the dorsal fin. The origin of the latter opposed to eighteen transverse rows of scales. The epaxal lobe of the caudal fin was incompletely preserved, the hypaxial lobe about includes nine distally segmented and branched rays. The bases of the epaxial and hypaxial lobes have basal fulcra.

Scales are rhombic, with enamel. Those on the anterior flank are much deeper than broad, but the height of the scales decrease dorsally, ventrally and posteriorly, are nearly equilateral or even broader than deep. All the scales are almost smooth, appear to be destitute of peg-and-socked articulation. There is a series of very strong dorsal ridge scales (at least 13 in number) between the head and dorsal fin, but are not connected with the dorsal fin. Between the dorsal ridge-scales and dorsal fin there is a space which is covered with three ordinary dorsal scales. The bases of the dorsal ridge-scales are sturdy, gradually pointed distally and spine-shaped.

Remarks *Tianfuichthys* gen. nov. resembles semionotid *Neolelepidotes* Chang et Chou in the body form, structure of skull-roof, cheek region, and in the absence of fringing fulcra etc., but it distinctly differs from *Neolepidotes* in having short distance of the preorbit, hinder situation of mandibular articulation, numerous extrascapulars, well developed dorsal ridge-scales, and in lacking peg-and-socked articulations of scales etc. *Tianfuichthys* is most akin to *Semionotus* Agassiz in the body form, relative situations of the fins, structure of dermal skull and opercular apparatus, characters of suborbitals and scales, and in having well deverloped dorsal ridge-scales ect., but it differs from *Semionotus* in several respects, such as the absence of the fringingfulcra, larger parietals and dermosphenotic, numerous extrascapulars, hinder situation of mandibular articution, and different form of preoperculum ect. In addition, *Semionotus* has a large posteriorly directed process on the epiotic, but in *Tianfuichthys* it has not been observed.

Tianfuichthys shares most of the semionotid characters, including: moderately deep fusiform body and relative situations of the fins resembling semionotids; presence of well developed dorsal ridge-scales; nearly vertical suspensorium; similar characters in the skull roofing bones, circumorbitals and opercular apparatus; suborbitals and scales resembling *Semionotus*; dorsal fin not extending more than half the length of the trunk.

Acording to the basic characteristics mentioned above, I believe that *Tianfuichthys* belong to the Semionotidae.

Tianfuichthys occurs in the Shaximiao Formation of Sichuan Basin. This formation is a continental deposits, and also yielded ptycholepiform *Chungkingichthys tachuensis* and *Yuchoulepis szechuanensis*, which were established by Su (1974) based on materials from many different localities of the Basin. Meanwhile he considered that these two

genera respectively resembles ptycholepidae and *Ptycholepis* from Lias of Europe and upper part of Newark Supergroup of eastern North America, that the age of the Shaximiao Formation is probably Middle Jurassic. Acording to Cornet, Traverse and McDonald (1973), the Newark Supergroup now known to be part of Late Triassic and part of Early Jurassic in age. Schaeffer and McDonald (1978), after studying the fishes from Newark Supergroup, pointed out that there are interesting changes in the time ranges of the Newark fishes. *Redfieldius* has become an exclusively Liassic taxon, whereas the other redifieldiids have remained Late Triassic. *Ptycholepis marshi* is also apparently restricted to the Liassic. At least one of the species presently included in the paraphyletic genus *Smionotus* remains Late Triassic, whereas the others are Liassic. *Diplurus* is the only Newark taxon that crosses the Triassic-Liassic boundary. The discovery of *Tianfuicthys* resembling *Semionotus* in Sichuan has further indicated the resemblance among the L.-M. Jurassic fish fauna in eastern Asia, Europe and North America.

图版 I 说明
(Explanations of plate I)

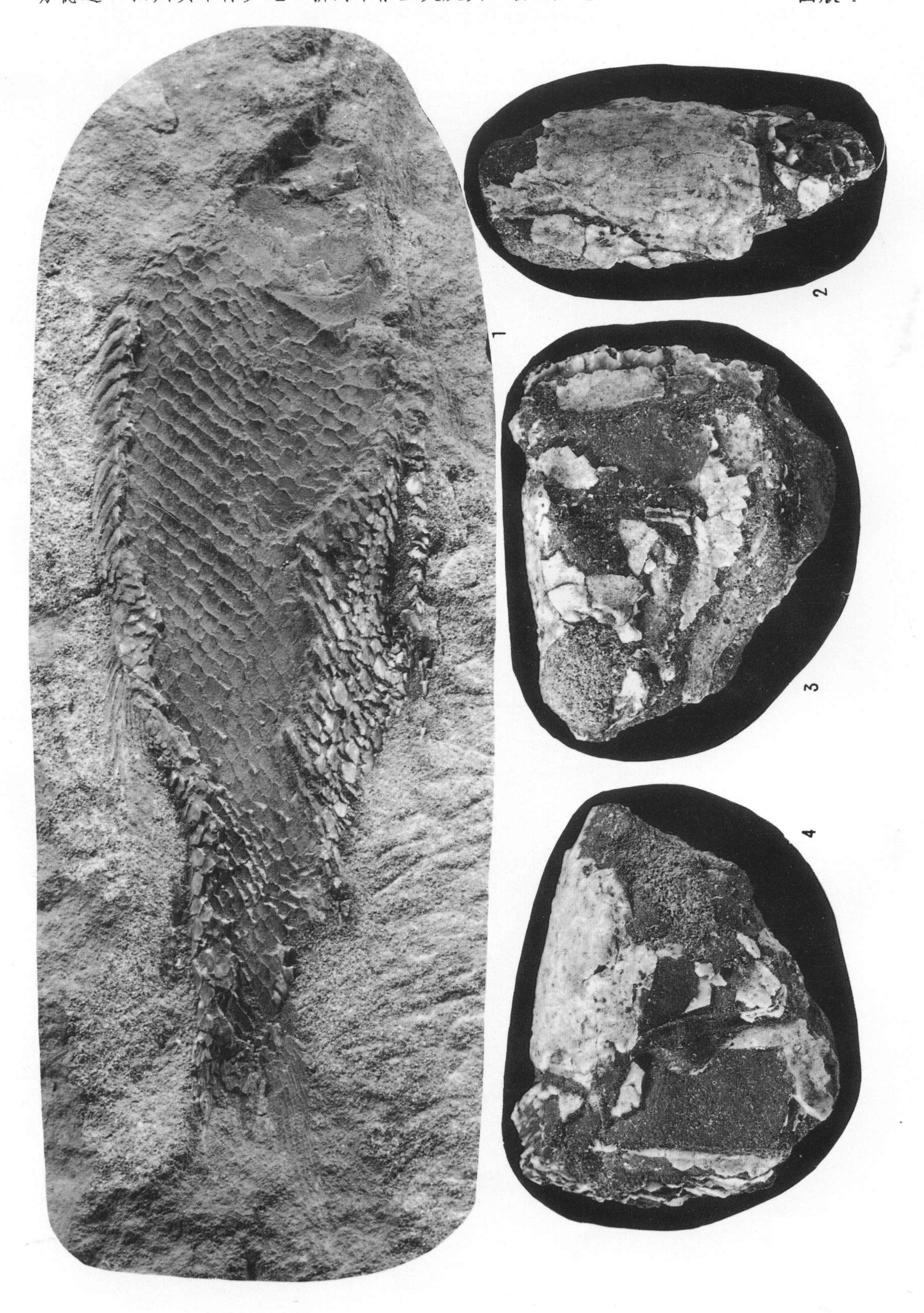
棘背天府鱼 *Tianfuichthys spinodorsalis* gen. et sp. nov.

1. 一近乎完整的鱼(正型标本)，右侧视。
A nearly complete fish (Holotype), V4095A, right side view, ×8/10.

2. 一分离的正型标本头骨，背面视。
An isolate skull of the Holotype (V4095B), dorsal side view, ×1.5.

3. 同一分离的正型标本头骨，左侧视。
An isolate skull of the Holotype (V4095B), left side view, ×1.5.

4. 同一分离的正型标本头骨，右侧视。
An isolate skull of the Holotype (V4095B), right side view, ×1.5.


1
2
3
4